BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION

In the Matter of	)	
Inquiry Regarding Carrier Current Systems	)	ET Docket No. 03-104
Including Broadband Over Power Line Systems	)	

COMMENTS OF
SATIUS, INC.

Satius, Inc. ("Satius"), by its attorneys, respectfully submits its comments in response to the Federal Communication Commission's ("Commission") Notice of Inquiry regarding Carrier Current Systems, specifically Broadband over Power Lines ("BPL") systems.[1]

I. INTRODUCTION AND SUMMARY

Satius is pleased with the Commission's focus on the deployment of BPL systems and shares the Commission's belief that BPL systems can coexist, without interference, with preexisting power line infrastructures with minimal changes to its Part 15 rules.[2] As noted by the Commission, in the *BPL NOI*, as power lines reach nearly all communities in the United States, BPL can become a significant competitive method of providing broadband infrastructure to the residential market as well as rural and other underserved areas.[3] Accordingly, the Commission has sought to obtain information on BPL technologies and evaluate possible adjustments to the its Part 15 rules.

Satius contends that with minimal changes to the Commission's Party 15 rules, as outlined below, BPL can be deployed without any low frequency disturbance in or out of a home

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1 *Inquiry Regarding Carrier Current Systems Including Broadband over Power Line Systems*, Notice of Inquiry, FCC 03-100, ET Docket No. 03-104 (rel. Apr. 28, 2003) ("*BPL NOI*").

2 Part 15 rule regulate carrier current systems that operate on an unlicensed basis, *see* 47 C.F.R §15 *et al*.

3 *BPL NOI* at ¶1.

or office. Furthermore, with standard equipment and power line communications systems, BPL can operate seamlessly within the frequency ranges of traditionally mature communications devices, such as television, radio and cellular phones. In order to allow this technology to develop such that it may become a competitive broadband technology, the Commission should establish frequency limits for Access BPL Systems provided over utility poles and medium voltage electric power lines, as well as In-House BPL Systems, provided inside a building.[4]

II. BACKGROUND

Satius was established in 1992 to develop and license power line carrier technology and has obtained numerous patents for such Power Line Communication ("PLC") technology. Satius-developed technology can simultaneously transmit and receive multi-channel carrier frequency bandwidths over power lines, while emitting minimal and stable emissions at carrier frequency transmissions with low signal harmonics. In 1994, Satius began the production of its patented digital signal processing ("DSP") BPL technology for video, voice, and data at the 2-30 Mhz bandwidth. Currently, one of Satius' licensees is selling a multi-channel power line video transmitter and receiver for security applications as well as a multi-channel transmission and receiver device that is placed in moving vehicles. Both products have been successful in international markets.

Satius' most recent technology for the broadband "last mile" solution will provide the following: (1) high-speed communications from each home to Satius' substation; (2) bidirectional connection of electric utility hubs through distribution transformers that do not require the traditional bridging devices to bypass the distribution transformers; (3) communications at greater distances than most current BPL technology and needing fewer line

[4] *See BPL NOI* at ¶3.

repeaters; and (4) stable and reliable signals with low emissions at the transmitted frequencies and very low harmonics, measured only in the noise floor.

One of the Commission's concerns with current PLC systems is that the equipment harmonics may interfere with the analog radio and television bands.[5] Other frequency bands that contain DSP over radio transmitters and receivers will have less effect from digital PLC equipment. Satius asserts that its technology should be regulated as a DSP power line transmitter, similar to DSP radio transmitters, whereby the signal emission can be limited and stabilized, *but as unintentional carrier current systems without the concomitant frequency band limitations of radio transmitters*. Accordingly, signal harmonics could be eliminated such that any nearby radio or BPL transmitter could coexist at similar or other frequencies on the same power line. In order to develop and produce this new technology, Satius recommends that the Commission modify its Part 15 rules to establish standard frequency limits for Access BPL and In-House BPL.

III. MODIFICATION OF COMMISSION'S FREQUENCY LIMITS FOR ACCESS BPL AND IN-HOUSE BPL

As stated by the Commission in its *BPL NOI*, the Part 15 rules "limit the amount of RF energy that may be injected into a building's wiring by an RF device that receives power from the commercial power source, including carrier current systems that couple RF energy into

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[5] The analog radio and television band is as follows:

(1) 535 Khz to 1.705 Mhz - AM broadcasting radio band
(2) 54 Mhz to 88 Mhz - AM TV broadcasting band
(3) 88 Mhz to 108 Mhz - FM broadcasting radio band
(4) 108 Mhz to 216 Mhz - AM TV broadcasting band
(5) 470 Mhz to 960 Mhz - AM TV, cable TV, cellular phone bands
(6) 1.8 Ghz to 2 Ghz - cellular phone bands

the AC wiring for communications purposes."[6] Imposing an RF injection limit on the power line would not be feasible because with the power line characteristic impedance changing in time and location, it will be difficult to come up with a standard injection receiving test device. Furthermore, companies may be able to easily design around such a limitation by designing power line couplers that will show low transmission levels into the power line test device, despite the fact that the transmission levels may actually generate emissions that interfere with the analog TV and radio bands. As such, the purposes behind establishing an RF injection limitation on the power line may easily be thwarted by BPL solutions that do not match the power line characteristic impedance but rather "fool" the RF injection tester. Since current power line grids are set up in a star configuration, similar more to wireless networks rather than an end to end twisted pair communication medium, any power line communication RF signal limitation should be similar to those limitations imposed on wireless signal emission and harmonics through the air rather than current limitations on twisted pair signal communication. As set forth below, Satius proposes alternative frequency limits to Access BPL and In-House BPL that are similar to such current wireless technologies.

A. Access BPL

The Commission notes that although several consortiums of BPL carriers are promoting Access BPL, the operating characteristics of BPL have not been standardized.[7] In an effort to assist the Commission in developing standard operating criteria, Satius recommends that the Commission establish standard frequency limits for BPL technologies that are similar to that of current wireless communications. Communications speeds of BPL technologies are compatible with the speeds of other wireless technologies, and therefore, the frequency limits

6 *See BPL NOI* at ¶5.

should be similar. With such limits in place, Access BPL can flourish as a competitive broadband technology and not remain an unintentional computer noise source from a power line.

When installing a BPL system on a mid voltage power line, utility companies, based on safety concerns, prefer to not install a repeater or bridge unit at every distribution transformer, as lightening can hit the transformer and cause burns, shorts and other harmful damage to consumers. These risks are significantly mitigated if the BPL communications signal can travel over mid/low voltage lines through the distribution transformers for a distance of at least one mile without a repeater.

In this regard, the Commission's proposed 1.7 to 80 Mhz carrier frequencies are not capable traveling such distances over distribution transformers and as such do not promote efficient communication. Indeed, in order to have effective transmission without a repeater, allotted frequencies must have at least 40 dB attenuation over transformers. Higher than 200 Mhz frequencies need to be used to communicate through the distribution transformers with low losses, and matching needs to be used to achieve magnetic waive guide over the mid/low voltage power line through its transformers. Accordingly, Satius proposes the following limitations to Access BPL analog and DSP systems.[8]

Frequency	**Field Strength**	**Measurement Distance**
9-490 Khz	2,400/F(Khz)	300 meter
0.49-1.705 Mhz	24,000/F(Khz)	30 meter
1.705-54 Mhz	500 uV/meter	300 meter
54-88 Mhz	100 uV/meter	30 meter
88-216 Mhz	150 uV/meter	30 meter
216-470 Mhz	500 uV/meter	300 meter
470-960 Mhz	200 uV/meter	30 meter
above 960 Mhz	500 uV/meter	300 meter

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[7] *Id*. at ¶14.

The measurement distances listed above are measured from the source of the DSP BPL system installed on the mid voltage power line or on the side of the building or house. The emission verification requirements are based on the Commission's current emission rules. Loop and Dipole antennas are used for measurement where such antennas are vertically one meter from the ground. The spectrum analyzer used shall be calibrated with 10 Khz resolution bandwidth to take such measurements. Furthermore, the frequency limits listed above should apply for any existing analog and DSP BPL system over the power line. Satius notes that if the above-listed limits are established, then the type of RF signal injection made into the low/mid/high power voltage lines is irrelevant and could be accomplished in numerous ways, including, but not limited to: (1) power line phase to ground; (2) between two or three phases; or (3) inductively coupling into the power line by a single wire.

It is important to note that utility companies report seven times larger emissions form a DSL system on telephone wires than from a BPL. Also important to note is that twisted pair wires, like telephone wires, have in most cases larger emission and harmonics than power line wires.

B. In-House BPL

As the Commission is aware, large buildings usually have transformers for 480/440V to 120 V on every floor. Safety regulations are a priority for utility companies when installing BPL System on low voltage power line in large buildings. As with Access BPL, utility companies are hesitant to install repeaters or bridge units at every 480V to 120V transformers for In-House BPL due to concerns about lightning damage. As such, utility companies would prefer to transmit In-House BPL on low voltage power lines, if the communication signal can travel

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[8] The limits shown in the above table are based on measurements employing an average detector.

through the distribution transformers for a distance of at least 1 mile without a repeater.

Similar to the Access BPL, the Commission's proposed 1.7 to 80 Mhz carrier frequencies are not capable of facilitating sufficient communications over the distribution transformers, as In-House BPL requires at least 40 dB attenuation over the transformers. Therefore, Satius recommends the following frequency limitations to In-House BPL analog and DSP systems:

Frequency	**Field Strength**	**Measurement Distance**
9-490 Khz	2,400/F(Khz)	300 meter
0.49-1.705 Mhz	24,000/F(Khz)	30 meter
1.705-54 Mhz	500 uV/meter	30 meter
54-88 Mhz	100 uV/meter	3 meter
88-216 Mhz	150 uV/meter	3 meter
216-470 Mhz	500 uV/meter	30 meter
470-960 Mhz	200 uV/meter	3 meter
above 960 Mhz	500 uV/meter	30 meter

As with Access BPL, the measurement distance is calculated from the house or building where the source of the DSP BPL System is installed inside the house or building on the low voltage power line. Similarly, the emission verification requirements will be made in accordance with the Commission's current emission rules.

IV. CONCLUSION

For the reasons discussed above, Satius recommends that the Commission establish frequency limit standards for Access BPL Systems and In-House BPL Systems which are equivalent to current wire and wireless systems as discussed and which promote the deployment of BPL as a alterative, competitive broadband solution.

Respectfully submitted,

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**Not admitted in Virginia.*